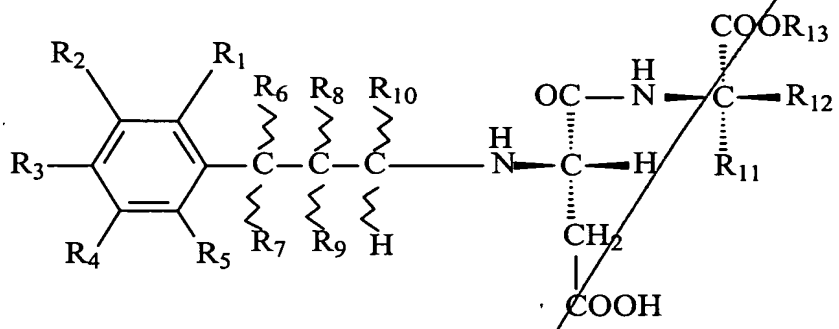
CLAIMS:

1. An N-alkylaspartyl dipeptide ester compound, and salts thereof, represented by the formula (1):



(1)

wherein R_1, R_2, R_3, R_4 and R_5 are independent from each other, selected from the group consisting of a hydrogen atom, a hydroxyl group, an alkoxy group having 1 to 3 carbon atoms, an alkyl group having 1 to 3 carbon atoms and a hydroxy alkyloxy group having two or three carbon atoms, and R_1 and R_2, or R_2 and R_3, optionally, form a methylene dioxy group, and R_4 and R_5, and R_1 or R_3 which do not form the methylene dioxy group are defined as above;

R_6, R_7 , R_8, R_9 and R_{10} are independent from each other, a hydrogen atom or an alkyl group with 1 to 3 carbon atoms; and optionally, two of R_6, R_7, R_8, R_9 and R_{10} may combine to form an alkylene group with 1 to 5 carbon atoms, and R_6, R_7, R_8, R_9 and R_{10} which do not form the alkylene group with 1 to 5 carbon atoms are defined as above;

R_{11} is selected from the group consisting of a hydrogen atom, a benzyl group, a p-hydroxy benzyl group, a cyclohexyl methyl group, a phenyl group, a cyclohexyl group, a phenyl ethyl group and a cyclohexyl ethyl group;

R_{12} is selected from the group consisting of a hydrogen atom and an alkyl group with 1 to 3 carbon atoms; and

R_{13} is selected from the group consisting of alkyl groups with 1 to 4 carbon atoms;

with the proviso that the following are excluded:

where R_6, R_7, R_8, R_9 and R_{10} are hydrogen atoms at the same time,

where R_6 is a methyl group, R_1, R_2, R_3, R_4, R_5, R_7, R_8, R_9, R_{10} and R_{12} are a hydrogen atom at the same time and R_{11} is a benzyl group or a p-hydroxy benzyl group, at the same time; and

where R_2 or R_4 are methoxy groups, R_3 is a hydroxyl group, R_{10} is a methyl group, R_1, R_4, R_5, R_6, R_7, R_8 and R_9 are hydrogen atoms at the same time, and R_{11} is a benzyl group or a p-hydroxy benzyl group.

2. The compound as defined in claim 1, wherein R_3 is a methoxy group, R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6 and R_{13} are methyl groups and R_{11} is a benzyl group.

3. The compound as defined in claim 1, wherein R_2 is a hydroxyl group, R_1, R_3, R_4, R_5, R_7, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6 and R_{13} are methyl groups, and R_{11} is a benzyl group.

4. The compound as defined in claim 1, wherein R_2 is a methoxy group, R_3 is a hydroxyl group, R_1, R_4, R_5, R_7, R_8, R_9, R_{10} and R_{12} arehydrogen atoms, R_6 and R_{13} are methyl groups and R_{11} is a benzyl group.

5. The compound as defined in claim 1, wherein R_2 is a hydroxyl group, R_3 is a methoxy group, R_1, R_4, R_5, R_7, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6 and R_{13} are methyl groups and R_{11} is a benzyl group.

6. The compound as defined in claim 1, wherein R_2 is a methoxyl group, R_3 is a hydroxy group, R_1, R_4, R_5, R_7, R_8, R_9, R_{10} and R_{13} arehydrogen atoms, R_6 and R_{13} are methyl groups and R_{11} is a p-hydroxy benzyl group.

7. The compound as defined in claim 1, wherein R_2 is a hydroxyl group, R_3 is a methoxy group, R_1, R_4, R_5, R_7, R_8, R_9, R_{10} and R_{13} are hydrogen atoms, R_6 and R_{13} are methyl groups and R_{11} is a cyclohexyl methyl group.

8. The compound as defined in claim 1, wherein R_3 is a methoxy group, R_1, R_2, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

9. The compound as defined in claim 1, wherein R_3 is a hydroxyl group, R_1, R_2, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

10. The compound as defined in claim 1, wherein R_2 is a methoxy group, R_3 is a hydroxyl group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

11. The compound as defined in claim 1, wherein R_2 is a hydroxyl group, R_3 is a methoxy group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

12. The compound as defined in claim 1, wherein R_2 is a methyl group, R_3 is a hydroxyl group, R_1, R_4, R_5, R_7, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6 and R_{13} are methyl groups, and R_{11} is a benzyl group.

13. The compound as defined in claim 1, wherein R_2 is a hydroxyl group, R_3 is a methoxy group, R_1, R_4, R_5, R_6, R_7, R_9, R_{10} and R_{12} are hydrogen atoms R_8 and R_{13} are methyl groups, and R_{11} is a benzyl group.

14. The compound as defined in claim 1, wherein R_1 is a hydroxyl group, R_2, R_3, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

15. The compound as defined in claim 1, wherein R_1 is a hydroxyl group, R_3 is a methoxy group, R_2, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

16. The compound as defined in claim 1, wherein R_1 is a hydroxyl group, R_3 is a methyl group, R_2, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

17. The compound as defined in claim 1, wherein R_2 and R_3 combine to form a

methylene dioxy group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

18. The compound as defined in claim 1, wherein R_2 is a methyl group, R_3 is a methoxy group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7, and R_{13} are methyl groups, and R_{11} is a benzyl group.

19. The compound as defined in claim 1, wherein R_2 is a methyl group, R_3 is a hydroxyl group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

20. The compound as defined in claim 1, wherein R_2 is a hydroxyl group, R_3 is a methyl group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

21. The compound as defined in claim 1, wherein R_2 is a methoxy group, R_3 is a hydroxyl group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6 and R_7 combine to form a tetramethylene group, R_{11} is a benzyl group, and R_{13} is a methyl group.

22. The compound as defined in claim 1, wherein R_2 is a hydroxyl group, R_3 is a methoxy group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6 and R_7 are methyl groups, R_{11} is a benzyl group, and R_{13} is an ethyl group.

23. The compound as defined in claim 1, wherein R_2 is a hydroxyl group, R_3 is a methoxy group, R_1, R_4, R_5, R_8, R_9 and R_{10} are hydrogen atoms, R_6, R_7, R_{12} and R_{13} are methyl groups, and R_{11} is a benzyl group.

24. The compound as defined in claim 1, wherein R_2 and R_3 is a hydroxyl group, R_1, R_4, R_5, R_8, R_9, R_{10} and R_{12} are hydrogen atoms, R_6, R_7 and R_{13} are methyl groups, and R_{11} is a benzyl group.

25. The compound as defined in claim 1, wherein when R_6 and R_7 differ, the carbon

atom to which R_8 is linked in said formula is in the (R), (S) or (RS) configuration.

26. The compound as defined in claim 1, wherein when R_8 and R_9 differ, the carbon atom to which R_8 is linked is in the (R), (S) or (RS) configuration.

27. The compound as defined in claim 13, wherein when R_8 and R_9 differ the carbon atom to which R_8 is linked is in the (R), (S) or (RS) configuration.

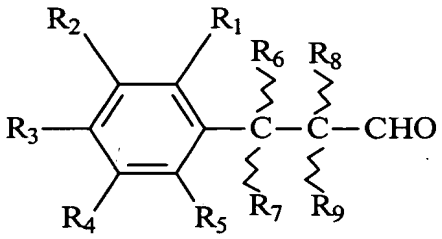
28. The compound as defined in claim 1, wherein when R_{10} is a substituent other than a hydrogen atom, the configuration of the carbon atom to which R_{10} is linked in said formula (1) is in the (R), (S) or (RS) configuration.

29. A composition comprising at least one compound of claim 1 and a carrier or bulking agent.

30. A method of imparting sweetness into a substance comprising adding at least one compound of claim 1 to said substance.

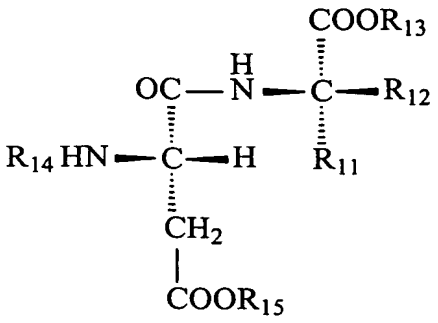
31. A method of producing the compound as defined in claim 1, wherein R_{10} is a hydrogen atom comprising:

reacting under reductive alkylation conditions an aldehyde having the formula (2):



(2)

wherein R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8 and R_9 have the same meanings as R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8 and R_9, respectively in the above formula (1), with an aspartame compound having the formula (3):



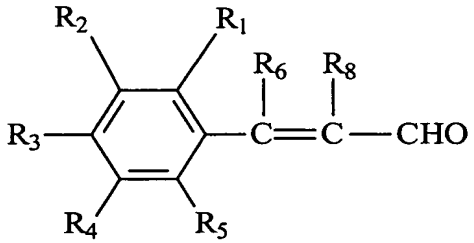
(3)

wherein R_{11}, R_{12} and R_{13} in formula (3) have the same meanings as R_{11}, R_{12} and R_{13} in formula (1), R_{14} is a hydrogen atom or a substituent which can be converted into a hydrogen atom and R_{15} is a hydrogen atom, benzyl group or a substituent which may be used to protect a carboxyl group.

32. The method as defined in claim 1, wherein R_{15} is a t-butyl group.

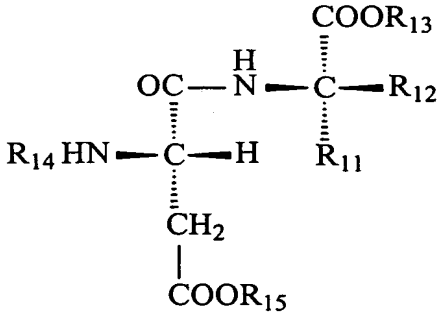
33. A method of producing the compound as defined in claim 1, wherein R_7, R_9 and R_{10} are a hydrogen atom comprising:

reacting under reductive alkylation conditions an aldehyde having the formula (4):



(4)

with an aspartame compound having the formula (3):

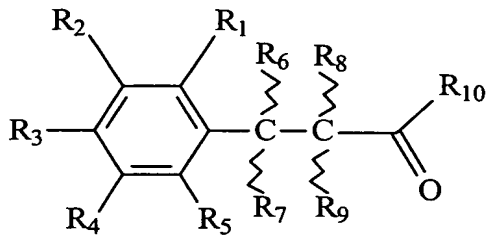


(3)

wherein R_{11}, R_{12} and R_{13} in formula (3) have the same meanings as R_{11}, R_{12} and R_{13} in formula (1), R_{14} is a hydrogen atom or a substituent which can be converted into a hydrogen atom and R_{15} is a hydrogen atom, benzyl group or a substituent which may be used to protect a carboxyl group.

34. A method of producing the compound as defined in claim 1, comprising:

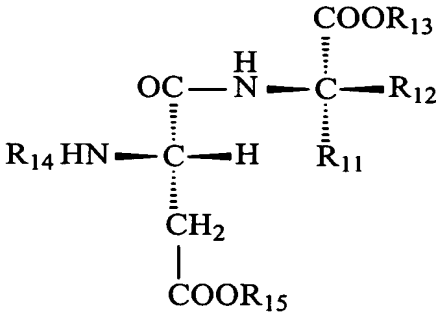
reacting under reductive alkylation conditions an aldehyde having the formula (5):



(5)

wherein R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8, R_9 and R_{10} have the same meanings as R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8, R_9 and R_{10}, respectively in formula (1);

with an aspartame compound having the formula (3):



(3)

wherein R_{11}, R_{12} and R_{13} in formula (3) have the same meanings as R_{11}, R_{12} and R_{13} in formula (1), R_{14} is a hydrogen atom or a substituent which can be converted into a hydrogen atom and R_{15} is a hydrogen atom, benzyl group or a substituent which may be used to protect a carboxyl group.